FAQ

Cellular agriculture has the potential to be a far-reaching development, impacting positively not only on our lifestyles but also on the environment, human health, animal welfare, social justice, and the global economy. Read on for everything you need to know about cellular agriculture.

THE BASICS

How and when will cultured products enter the market?

In December 2020, Eat Just was the first company to get regulatory approval for a cultured product when their cultured-chicken bites, which are mixed with plant proteins, were approved for sale in Singapore. Eat Just is now selling the product in their partner restaurant 1880 in Singapore, making one of the first commercially available cultured-meat products. Prior to that, the company SuperMeat opened the first cultured-meat restaurant in Tel Aviv, a test kitchen where it offers cultured chicken fillet in order to get feedback on their product while still in the development stage. Predictions regarding the widespread availability of cultured products range from "quite soon" to "several years". After being made available in selected restaurants, production will need to be scaled up before products are widely available on supermarket shelves. For example, Aleph Farms is currently preparing for a market launch in 2022[1] while the Spanish company Multus Biotechnology plans to have their cultured meat in supermarkets by 2027.[2]

How long does it take to produce a cultured hamburger?

Pioneering company, Mosa Meat, assumes that it takes 10 weeks to produce one hamburger patty, but only about 12 weeks to produce 100,000 patties. In comparison, it takes about 18 months to raise a cow for slaughter, which yields up to 1,500 patties.[3]

How much will cultured products cost?

Bringing production costs down is one of the key challenges facing cellular agriculture. The early stages of most new technologies tend to be expensive – the first cultured burger produced by Mark Post in 2013 cost €250,000 to produce! However, in the long run, cellular-agriculture producers aim to make their products affordable, and cultured products are expected to reach price parity with meat in the coming years. Ultimately, it is expected that cultured products will be cheaper than their conventional animal-based counterparts, as fewer resources are needed to produce them.

How big is the sector?

Cellular agriculture is an emerging field born of the desire to produce good, healthy, and sustainable animal-based foods. A growing number of universities, along with about 60 companies and startups around the world, including some of the world's leading meat producers, are currently working on developing cellular-agriculture products.

CULTURED AND PLANT-BASED PRODUCTS

Why develop cultured products when there are plant-based alternatives available?

While ProVeg considers a plant-based diet the most sustainable option, when it comes to taste, ease, and perceptions, plant-based alternatives do not (yet) appeal to all consumers. This is due to a lower sensory and gustatory attractiveness compared to conventional animal-based products. Additionally, it is difficult for many consumers to change eating habits that they have developed over the course of a lifetime.[4] This is why we consider cellular agriculture such a promising complement to plant-based alternatives for the many consumers who find it particularly challenging to change their dietary behaviours and preferences.

Offering products that people already know and enjoy, but without the negative impacts on the environment, human health, and animal welfare, could be a key factor in improving our food system. Making the ethical choice the easy choice can reduce the psychological and social efforts required for behavioural and hence systemic change. Given the global scale of the challenge as well as the urgent need for change, exploring all promising options is imperative.

Are cultured products vegan?

In the strict sense of the word, these products are not vegan since the initial cells that form the basis of cultured products are of animal origin. However, it is quite obvious that cultured meat, eggs, and dairy avoid all the negative effects that veganism also aims to avoid. And, of course, cultured eggs and dairy would still be vegetarian. It is important to note that cultured products are not aimed specifically at vegans or vegetarians, but at flexitarians and other consumers who find it particularly challenging to shift away from animal products.

THE PROCESS

Are cultured products genetically modified?

Cultured meat can be produced without genetic modification. European startups, in particular, are planning not to use genetic modification in their production processes. Instead, cultured eggs and dairy proteins are produced using fermentation processes from microorganisms. The production of proteins using fermentation is nothing new – it has been done for several decades in the medical field (making it possible to produce perfectly assimilable insulin for humans), as well as in the production of everyday consumer products.

Some of the best-known examples regarding food are rennet (a necessary component for the production of cheese), vanillin (the primary component of the extract of the vanilla bean), amylase (an enzyme commonly used in bread-making), and pectinase (an enzyme used in theproduction of fruit juice). All of these ingredients are currently obtained using the fermentation of microorganisms. Additionally, there are numerous examples of traditional fermented foods, from tempeh to beer, yoghurt, kimchi, sauerkraut, and many others.

What quantity of meat can be produced with this approach?

According to one recent estimate, one cell sample could create up to 10,000 kg of cultured meat. This suggests that, theoretically, we would only need 150 cows to satisfy the world's meat demand. In contrast, at present there are more than 1.5 billion cows populating the planet at any point in time.[5]

Are animals still needed?

In order to produce meat, some cellular agriculture startups are exploring alternatives to animal biopsies, including the use of feathers or umbilical cords to harvest cells. Scientists are also working on immortalised cell lines (which proliferate longer) in order to produce meat, while relying less on animal biopsies. For the precision-fermentation method used to produce products such as milk and egg-white proteins, no animal is needed since the DNA sequences needed to produce them are already known.

Is Fetal Bovine Serum (FBS) necessary?

In order to multiply and differentiate as they would inside of an animal, cells in the cellular agriculture process are grown in a nutrient-rich medium containing the same amino-acids, proteins, sugars, vitamins, and growth factors that are found in the animal's blood. In cellular agriculture's initial stage, researchers used Fetal Bovine Serum – adopting the standard growth method of medical tissue engineering. Despite offering perfect conditions as a growth medium, FBS has serious ethical and economic downsides: it is a by-product of cattle slaughter, and it is excessively expensive, rendering large-scale production at a reasonable price impossible. As such, current research is focusing on replacing FBS with plant-based alternatives. In 2019, Mosa Meat claimed to have successfully created the first animal-free medium.[6]

CONSUMERS

Will consumers accept cultured products?

Several surveys conducted in Europe and the US show that the more informed people are about the various benefits of cellular agriculture, the more willing they are to engage with cultured meat. According to studies, 50%[7] to 95%[8] of European consumers are willing to buy cultured meat, after having been provided with relevant information. Another study showed that Chinese respondents were very likely or extremely likely to purchase cultured meat – twice as likely as Americans respondents in the same study (59.3% versus 29.8%) and 10% more likely than participants from India.[9] Most studies also suggest that the acceptance of cultured meat is higher amongst men, the educated, the young, urbanites, and meat consumers.[10]

What is the nutritional value of cultured meat?

The Singaporean Food Agency analysed the nutritional value of Eat Just's cultivated chicken and found it to be comparable to conventional animal meat. "Safety and quality validations demonstrated that harvested cultured chicken met the standards of poultry meat, with extremely low and significantly cleaner microbiological content than conventional chicken. The analysis also demonstrated that cultured chicken contains a high protein content, diversified amino acid composition, high relative content in healthy monounsaturated fats and is a rich source of minerals."[11]

Are cultured products safe?

Cultured meat is safer than conventional meat because it is produced in a sterile environment with a far lower risk of bacterial infection, faecal contamination, and the spread of zoonotic diseases. Of course, cultured products will have to undergo the same regulatory processes and safety tests as any novel food item before being authorised for commercial sale.

Food regulation agencies that are responsible for the quality and safety control of cellular-agriculture products include the Food and Drug Administration (FDA) and the United States Department of Agriculture in the United States, the European Food Safety Authority in Europe, the National Food Safety and Quality Service in Argentina, and the Department of Agriculture, Forestry and Fisheries, the Department of Health, and the Department of Trade and Industry in South Africa.

Two approvals were granted in 2020. In March, the FDA recognised the fermented whey protein produced by the startup Perfect Day as safe, accrediting it with the 'generally recognised as safe' (GRAS) designation.[12] The first cultured-meat product was approved by the Singapore Food Agency in December, when Eat Just's chicken bites received regulatory approval.

How does cellular agriculture impact farmers?

Farmers are an integral part of our food system. Cellular agriculture offers animal farmers an opportunity to identify new areas of focus and remodel their businesses. For instance, they might consider cultivating crops for the expanding plant-based food sector, provide raw materials for cellular agriculture, or choose to produce conventional products with very high standards.

They could also decide to enter the cultured-meat, -eggs, and -dairy industry – some farmers have already expressed interest, including Illtud Dunsford, who founded his own cultured-meat startup[13] in the UK. Given the highly unsustainable system of current industrial animal agriculture, which swallows billions in subsidies each year while yielding insufficient profits for most farmers, cellular agriculture might open up new and more lucrative business opportunities.

In addition, animal agriculture is increasingly impacted by the detrimental effects of climate change, to which the sector contributes significantly, creating a strong motivation for transitioning away from the current model.

Are cultured products natural?

Humans have been producing cultured foods for thousands of years, including alcohol, cheese, and numerous traditional foods. Cellular-agriculture products would just be as natural as these products. Conventionally produced meat, eggs, and dairy, on the other hand, are quite unnatural.

Today, 90% of farmed animals worldwide come from factory farms[14] – with various problematic implications, from breeding to raising to slaughter: the animals we eat are the result of genetic selection in order to grow faster and bigger. Chickens, for instance, grow twice as fast as they did 30 years ago, reaching their slaughter weight in around 40 days, resulting in serious health problems.[15]

Today, most animals are raised in unnatural numbers and unnatural environments without access to sunlight or fresh air, have to undergo unnatural procedures such as dehorning and debeaking, and are fed unnatural foods. To prevent diseases resulting from those unnatural living conditions – and to increase profitability – farmed animals are treated with various substances such as antibiotics. Finally, they are transported and killed under circumstances that are difficult to consider natural. Cellular agriculture avoids all of these problems while providing the same end products.

REFERENCES

1 Gaynor Selby (2021): Aleph Farms attracts US$105M from "top-tier partners" as cultivated meat poised for market entry, in Food Ingredient First. Available at: https://www.foodingredientsfirst.com/news/aleph-farm-attracts-us105m-from-top-tier-partners-as-cultivated-meat-poised-for-market-entry.html [29/07/2021]

2 Flora Southey (2021): Innovating growth media for 'cost-competitive' cultivated meat: 'We want to see products competing with conventional meat in supermarkets by 2027', in Food Navigator. Available at: https://www.foodnavigator.com/Article/2021/07/19/Multus-Biotechnology-innovates-growth-media-for-cost-competitive-cultivated-meat [29/07/2021]

3 Mosa Meat (2018): FAQ. Available at https://static1.squarespace.com/static/5a1e69bdd7bdce95bf1ec33b/t/5bb365fbf4e1fcf778e2c7a3/1538483708590/FAQ_MM+website_Oct18.pdf [22.05.2020]

4 Hoek, A. C., P. A. Luning, P. Weijzen, et al. (2011): Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. Appetite. 56, p.662–673

5 Mosa Meat (2018): FAQ. Available at https://static1.squarespace.com/static/5a1e69bdd7bdce95bf1ec33b/t/5bb365fbf4e1fcf778e2c7a3/1538483708590/FAQ_MM+website_Oct18.pdf [22.05.2020]

6 Mosa Meat (2019): Growth Medium without Fetal Bovine Serum (FBS). Available at https://www.mosameat.com/blog/2019/11/15/mosa-meat-on-netflixs-explained [22.05.2020]

7 Flycatcher (2013): Kweekvlees [Cultured meat]. Available at http://www.flycatcherpanel.nl/news/item/nwsA1697/media/images/Resultaten_onderzoek_kweekvlees.pdf [20.05.2020]

8 Rolland NCM, Markus CR, Post MJ (2020) The effect of information content on acceptance of cultured meat in a tasting context. PLoS ONE 15(4): e0231176. Available at https://doi.org/10.1371/journal.pone.0231176 [22.05.2020]

9 Bryant C, Szejda K, Parekh N, Desphande V and Tse B (2019): A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China. Front. Sustain. Food Syst. 3:11. doi: 10.3389/fsufs.2019.00011

10 Bryant C and Barnett J (2018): Consumer acceptance of cultured meat: A systematic review.143. Meat Science. 10.1016/j.meatsci.2018.04.008

11 (2020): Eat Just Granted World's First Regulatory Approval for Cultured Meat. Available at: https://www.businesswire.com/news/home/20201201006251/en/Eat-Just-Granted-World%E2%80%99s-First-Regulatory-Approval-for-Cultured-Meat [25.11.2021]

12 FDA (US Food and Drug Administration) (2020): GRAS Notice GRN 863 Agency Response Letter. Available at: https://www.fda.gov/media/136751/download [26.01.2021]

13 ProVeg (2021): Building a Synergy between Traditional Agriculture and Cellular Agriculture. Available at: https://proveg.com/blog/traditional-and-cellular-agriculture/ [22.02.2022]

14 Jacy Reese (2019): US Factory Farming Estimates, Sentience Institute. Available at https://www.sentienceinstitute.org/us-factory-farming-estimates [22.05.2020]

15 CIWF (2019): The Life of: Broiler Chickens. Available at https://www.ciwf.org.uk/media/5235306/The-life-of-Broiler-chickens.pdf [22.05.2020]